SEMESTER – V

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	CL20501	Computer Networks	3	0	0	3
2	PC	CL20502	Foundations of Data Science	3	0	0	3
3	HS	BA20151	Entrepreneurship Development	3	0	0	3
4	PC	CL20503	Software Engineering	3	0	0	3
5	PC	CL20504	Deep Learning	3	0	0	3
6	PE	CL2015*	Professional Elective – I	3	0	0	3
Practical							
7	PC	CL20505	Computer Networks Laboratory	0	0	4	2
8	PC	CL20506	Deep Learning Laboratory	0	0	4	2
9	EE	EN20501	Career Development Laboratory I	0	0	2	1
TOTAL				**18**	**00**	**10**	**23**

SEMESTER – VI

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	CL20601	AI and Robotics	3	0	0	3
2	PC	CL20602	Data Analytics	3	0	0	3
3	PC	CL20603	Internet of Things	3	0	0	3
4	PC	CL20604	Optimization Techniques	3	0	0	3
5	PE	CL2025*	Professional Elective – II	3	0	0	3
6	OE	CL2090*	Open Elective – I	3	0	0	3
Practical							
7	PC	CL20605	AI and Robotics Laboratory	0	0	2	1
8	PC	CL20606	Data Analytics Laboratory	0	0	4	2
9	EE	EN20601	Career Development Laboratory II	0	0	2	1
TOTAL				**18**	**00**	**08**	**22**

PROFESSIONAL ELECTIVES (PE)

PROFESSIONAL ELECTIVE – I

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	CL20151	Cyber Security	3	0	0	3
2	PE	CL20152	Information Extraction and Retrieval	3	0	0	3
3	PE	CL20153	Advanced Machine Learning	3	0	0	3
4	PE	CL20154	Nature Inspired Computing Techniques	3	0	0	3

PROFESSIONAL ELECTIVE – II

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	CL20251	Engineering Predictive Analytics	3	0	0	3
2	PE	CL20252	Computer Vision	3	0	0	3
3	PE	CL20253	Block Chain and Cryptography	3	0	0	3
4	PE	CL20254	Human Machine Interaction	3	0	0	3

PROFESSIONAL ELECTIVE – III

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	CL20351	Natural Language Processing	3	0	0	3
2	PE	CL20352	Data and Information Security	3	0	0	3
3	PE	CL20353	Cognitive Systems	3	0	0	3
4	PE	CL20354	Computational Neuroscience	3	0	0	3

PROFESSIONAL ELECTIVE – IV

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	CL20451	Agile Methodologies	3	0	0	3
2	PE	CL20452	Operations and Supply Chain Management	3	0	0	3
3	PE	CL20453	Image and Video Analytics	3	0	0	3
4	PE	CL20454	Principles of Management	3	0	0	3

PROFESSIONAL ELECTIVE – V

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	CL20551	Soft Computing in Medical Diagnostics	3	0	0	3
2	PE	CL20552	Cryptography and Network Security	3	0	0	3
3	PE	CL20553	Ethics of AI	3	0	0	3
4	PE	CL20554	Big Data Analytics	3	0	0	3

PROFESSIONAL ELECTIVE – VI

S.No	Category	Course Code	Course Title	L	T	P	C
1	PE	CL20651	Wireless Sensor Networks	3	0	0	3
2	PE	CL20652	Knowledge Based AI	3	0	0	3
3	PE	CL20653	Social Network Analytics	3	0	0	3
4	PE	CL20654	Business Analytics	3	0	0	3

OPEN ELECTIVE I

S.No	Category	Course Code	Course Title	L	T	P	C
1	OE	CL20901	Green Computing	3	0	0	3
2	OE	CL20902	Artificial Intelligence	3	0	0	3

OPEN ELECTIVE II

S.No	Category	Course Code	Course Title	L	T	P	C
1	OE	CL20903	Data Science	3	0	0	3
2	OE	CL20904	Software Project Management Systems	3	0	0	3

SEMESTER – V

CL20501	COMPUTER NETWORKS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1. understand the protocol layering and physical level communication.
2. list the various components required to build different networks.
3. learn the functions of network layer and the various routing protocols.
4. familiarize the functions and protocols of the transport layer.
5. list the various protocols of application layer.

UNIT I	INTRODUCTION AND PHYSICAL LAYER	9

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II	DATA LINK LAYER & MEDIA ACCESS	9

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III	NETWORK LAYER	9

Introduction – Forwarding and Routing – Network services models – Ipv4 Addresses – Forwarding of IP Packets – Network Layer Protocols: Ipv4, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – Ipv6 Addressing – Ipv6 Protocol.

UNIT IV	TRANSPORT LAYER	9

Introduction – Transport Layer Protocols – Services – Multiplexing and De-Multiplexing – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

UNIT V	APPLICATION LAYER	9

WWW and HTTP – FTP – Email – Telnet – SSH – DNS – Peer to Peer applications – SNMP.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	compare the protocol layering and physical level communication.	Understanding (K2)
CO2	analyze the various components required to build different networks.	Analyzing (K4)
CO3	examine the functions of network layer and the various routing protocols.	Analyzing (K4)
CO4	explore the functions and protocols of the transport layer.	Analyzing (K4)
CO5	illustrate the various protocols of application layer.	Analyzing (K4)

TEXT BOOKS

1. Behrouz A.Forouzan, "Data Communication and Networking", Fifth Edition, Tata McGraw-Hill, 2013.

2. Nader.F.Mir, "Computer and Communication Networks", Second Edition, Pearson Prentice Hall Publishers, 2014.

REFERENCES

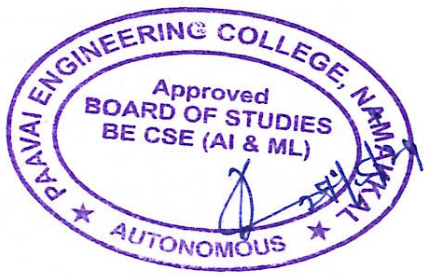
1. James F.Kurose, Keith W.Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Sixth Edition, Pearson Education, 2013.
2. Larry L.Peterson, Bruce S.Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2012.
3. William Stallings, "Data and Computer Communication", Tenth Edition, Pearson Education, 2013.
4. Alan Dennis, Jerry FitzGerald, Alexandra Durcikova, "Business Data Communications and Networking", 14th Edition, ISBN: 978-1-119-70284-9.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	3	2	2	-	-	1	-	-	1	1	3	2
CO2	2	2	3	1	1	-	-	1	-	-	2	1	3	2
CO3	3	2	3	2	2	-	-	2	-	-	2	1	3	2
CO4	3	2	3	2	2	-	-	2	-	-	2	1	3	2
CO5	1	3	2	2	2	-	-	2	-	-	2	1	3	3



CL20502	FOUNDATIONS OF DATA SCIENCE	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the key concepts of Data Science and its Applications.
2.	analyze the results on Data Collection and Data Pre-Processing.
3.	recall the mathematical concepts for descriptive and statistical analysis of the given dataset.
4.	apply Model development and evaluation.
5.	analyze the results on Model Evaluation metrics and validation.

UNIT I	INTRODUCTION	9

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues

UNIT II	DATA COLLECTION AND DATA PRE-PROCESSING	9

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

UNIT III	EXPLORATORY DATA ANALYTICS	9

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

UNIT IV	MODEL DEVELOPMENT	9

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

UNIT V	MODEL EVALUATION	9

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting – Under Fitting and Model Selection Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	apply the key concepts of Data Science and its Applications.	Applying (K3)
CO2	examine results on Data Collection and Data Pre-Processing.	Analyzing (K4)
CO3	investigate the Graph in Statistics.	Analyzing (K4)
CO4	identify the Model Development using various methods.	Analyzing (K4)
CO5	analyze the Model Evaluation metrics and validation.	Analyzing (K4)

TEXT BOOKS

1. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2015.
2. Jojo Moolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, 2016.

REFERENCES

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC, 2013.
2. Avrim Blum, John Hopcroft, Ravindran Kannan, "Foundations of Data Science", Cambridge University Press, 2020, ISBN: 978-1108485067.
3. Davy Cielen, Arno Meysman and Mohamed Ali, "Introducing Data Science", Manning Publications.
4. Dr. D. Shanthi 4ophia, Dr. S. Shanmugam, Dr. Selvareegan, Dr. P. Deivendran, Dr. selvarani, "Foundations of data science", Charulatha Publications, ISBN: 978-9395211284.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	2	-	-	-	-	-	-	1	2	2	2
CO2	2	1	2	1	-	-	-	-	-	-	1	2	2	3
CO3	2	2	1	2	-	-	-	-	-	-	1	3	2	2
CO4	3	2	2	1	-	-	-	-	-	-	2	2	3	3
CO5	2	2	1	2	-	-	-	-	-	-	1	2	2	2

BA20151	ENTREPRENEURSHIP DEVELOPMENT	3	0	0	3
Common to all B. E and B. Tech Program					

COURSE OBJECTIVES	
To enable the students to	
1.	understand the management principles.
2.	build the entrepreneurial competencies and analyse the support rendered by government and other agencies in entrepreneurship development.
3.	understand the business opportunities & to prepare a Feasibility Report.
4.	propose a business plan.
5.	appraise & comprehend the various factors to be considered for launching a small business.

UNIT I	BASICS OF MANAGEMENT	9

Management: Meaning, Definition, Nature & Importance; Roles of management – Functions of Management – Levels of Management – Functional areas of Management: Marketing, Finance, Production, HRM, IT, Research & Development.

The Evolution & Development of Management Thought: Classical, Neo-classical, System and Contingency Approaches – An Overview.

UNIT II	ENTREPRENEURIAL COMPETENCE & ENVIRONMENT	9

Entrepreneurial Competence: Entrepreneurship – Definition, Role and expectations – Entrepreneurial styles and types – Characteristics of the Entrepreneur – Entrepreneurial Competencies – Functions of an Entrepreneur.

Entrepreneurial Environment: Role of Socio-Cultural, Economic and Political Environment – Institutional Support for small entrepreneurs, Assistance Programme for Small Scale Units – Institutional Framework, Central and State Government Industrial Policies and Regulations.

UNIT III	ENTREPRENEURIAL DEVELOPMENT	9

Ownership Structures – Proprietorship, Partnership, Company, Co-operative, Franchise.

Identification of Business Opportunity – Preparation of Feasibility Report – Financial and Technical Evaluation – Project Formulation – Common Errors in Project Formulation – Specimen Project Report.

Entrepreneurial Development Programs — Role of SSI Sector in the Economy – SSI Units – Failure, Causes and Preventive Measures – Turnaround Strategies.

UNIT IV	BUSINESS PLAN PREPARATION, FINANCING VENTURES	9

Business Plan: Business opportunities-SWOT, Business plan process, Feasibility Study, Functional plan- Marketing plan, Operational plan, Organizational plan, financial plan, Evaluation Criteria.

Financing ventures: sources of raising capital, seed funding, venture capital funding, funding opportunities for start-ups in India.

UNIT V	WOMEN ENTREPRENEURSHIP & ENTREPRENEURSHIP IN VARIOUS SECTORS	9

Women Entrepreneurship: Growth of women Entrepreneurship – Problems faced by Women Entrepreneurs – Development of women Entrepreneurship.

Entrepreneurship in Informal Sector: Rural Entrepreneurship – Entrepreneurship in Sectors like Agriculture, Tourism, Health care, Transport and allied services.

		TOTAL PERIODS	45
COURSE OUTCOMES			
At the end of this course, students will be able to		**BT Mapped (Highest Level)**	
CO1	implement the necessary managerial skills to become an entrepreneur.	Understanding (K2)	
CO2	take up self-employment having been exposed to entrepreneurial environment.	Understanding (K2)	
CO3	select a best business idea by using appropriate methods to assess its viability.	Applying (K3)	
CO4	formulate a business plan & deploy the resources for sustainable growth.	Understanding (K2)	
CO5	analyse channels and means of launching a small business in any sector.	Applying (K3)	

TEXT BOOKS

1. Khanka S.S, "Entrepreneurial Development", S. Chand & Company Limited, New Delhi, 2016.
2. Saravanavel. P, "Entrepreneurial Development", Ess Pee Kay Publishing House, Chennai, 2013.

REFERENCES

1. Mathew Manimala, "Entrepreneurship Theory at the Crossroads", Paradigms & Praxis, Biztrantra, 2nd Edition, 2015.
2. Prasanna Chandra, "Projects – Planning, Analysis, Selection, Implementation and Reviews", Tata McGraw-Hill, 2013.
3. P.C.Jain, "Handbook for New Entrepreneurs", EDII, Oxford University Press, New Delhi, 2012.
4. Donald L. Sexton & Raymond W.Smilor, "The Art and Science of Entrepreneurship", Ballinger Publishing Company, 2008.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	3	1	-	2	2	2	-	2	3	2	3
CO2	-	2	2	-	2	1	-	-	-	-	1	`1	1	3
CO3	-	1	1	-	1	1	1	-	1	1	1	3	-	3
CO4	1	1	-	-			1		3	1	1	3	1	2
CO5	1	1	1	-	1	2	2	-	2	1	-	3	-	1

CL20503	SOFTWARE ENGINEERING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	select Software life cycle models and Process models for developing a system from scratch.
2.	understand fundamental concepts of requirement engineering.
3.	acquire knowledge about Design levels of software engineering.
4.	learn various software testing methods.
5.	study the software project management concepts.

UNIT I **SOFTWARE PROCESS** **9**

The Evolving role of Software – Software – The changing Nature of Software Legacy Software – A generic view of process – A layered Technology – A Process Framework – The Capability Maturity Model Integration (CMMI) – Process Assessment – Personal and Team Process Models-Product and Process; Process Models – The Waterfall Model – Incremental Process Models – Incremental Model, The RAD Model – Evolutionary Process Models – Prototyping, The Spiral Model, The Concurrent Development Model – Specialized Process Models – The Unified Process.

UNIT II **SOFTWARE REQUIREMENTS AND ANALYSIS** **9**

Requirements Engineering- Requirements Engineering tasks – Initiating the requirements Engineering Process – Eliciting Requirements – Developing Use cases – Building the Analysis Models – Elements of the Analysis Model, Analysis pattern Negotiating Requirements Validating Requirements; Requirements Analysis- Analysis Modelling approaches – data modelling concepts – Object oriented Analysis – Scenario based modelling – Flow oriented Modelling – Class based modelling – creating a behavior model.

UNIT III **SOFTWARE DESIGN** **9**

Design Engineering, Design process, Design Quality, Design Model – Agile Methods – Extreme Programming – Rapid Application development – Software Prototyping – Software Reuse – Application Frameworks – Application System Reuse – Software Evolution Program – Evolution Dynamics – Software Maintenance – Evolution Processes – Legacy system evolution Planning; Verification and Validation- Software Inspections – Automated Static analysis – Verification and Formal methods.

UNIT IV **SOFTWARE TESTING AND IMPLEMENTATION** **9**

Software testing fundamentals Verification and Validation – Internal and external views of Testing – white box testing – basis path testing – control structure testing-black box testing – Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging – Selenium Basics.

UNIT V **SOFTWARE PROJECT MANAGEMENT** **9**

Software Cost Estimation Productivity Estimation Techniques Algorithmic Cost Modelling – Project Duration and Staffing; Process and Product Quality – Quality Assurance and Standards – Planning – Control – Software Measurement and Metrics – Process Improvement – Process Classification Measurement Analysis and Modelling – Change; Configuration Management Planning Change Management – Version and Release Management – System Building.

TOTAL PERIODS **45**

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	classify the different process models.	Applying (K3)
CO2	apply fundamental concepts with analysis and modelling for any software requirement.	Applying (K3)
CO3	examine different methods for the design of a software system.	Applying (K3)
CO4	imply software testing methods.	Applying (K3)
CO5	implement documentation for software engineering process.	Applying (K3)

TEXT BOOKS

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", Mc-Graw Hill International, Eighth edition, 2015. (UNIT-I, II, IV)
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education,2011. (UNIT-III, V)

REFERENCES

1. Roger Pressman, Bruce Maxim, "Software Engineering: A Practitioner's Approach", 9th Edition, McGraw Hill Publisher, ISBN: 978-9355325044
2. Shari P fleeger, Joanne Atlee, "Software Engineering: Theory and Practice", Fourth Edition, Pearson Education, 2010.
3. Richard E. Fairley, "Principles of Software Engineering", IEEE computer society press, 2010.
4. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	1	-	-	-	3	-	-	2	2	2	1
CO2	3	2	3	1	-	-	-	2	-	-	2	3	1	2
CO3	3	3	3	3	-	-	-	1	-	-	1	2	2	1
CO4	3	3	3	3	-	-	-	1	-	-	1	2	2	1
CO5	3	3	2	1	-	-	-	3	-	-	3	3	1	3

CL20504	DEEP LEARNING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	present the basics of neural networks.
2.	study the concepts of deep learning.
3.	introduce dimensionality reduction techniques.
4.	understand deep learning techniques to support real-time applications.
5.	analyze the case studies of deep learning techniques.

UNIT I	INTRODUCTION	9

Introduction to Machine Learning – Linear models (SVMs, Perceptrons, and logistic regression) – Introduction to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

UNIT II	DEEP NETWORK	9

History of Deep Learning – A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization – VC Dimension and Neural Nets – Deep Vs Shallow Networks – Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

UNIT III	DIMENTIONALITY REDUCTION	9

Linear (PCA, LDA) and manifolds, metric learning – Auto encoders and dimensionality reduction in networks – Introduction to Convnet – Architectures – AlexNet, VGG, Inception, ResNet – Training a Convnet: weights initialization, batch normalization, hyper parameter optimization.

UNIT IV	OPTIMIZATION AND GENERALIZATION	9

Optimization in Deep Learning – Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM – Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning – Computational & Artificial Neuroscience.

UNIT V	CASE STUDY AND APPLICATIONS	9

Imagenet – Detection-Audio WaveNet-Natural Language Processing Word2Vec – Joint Detection- Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	explain the basics of deep learning and implement various deep learning models.	Understanding (K2)
CO2	extend high dimensional data using deep learning techniques.	Understanding (K2)
CO3	analyze optimization and generalization in deep learning.	Analyzing (K4)
CO4	examine the deep learning techniques.	Analyzing (K4)
CO5	distinguish various case studies and its applications.	Analyzing (K4)

TEXT BOOKS

1. Cosma Rohilla Shalizi, "Advanced Data Analysis from an Elementary Point of View", 2015.
2. Deng and Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.

REFERENCES

1. Seth Weidman, "Deep Learning from Scratch", O'Reilly, 2019, ISBN: 978-9352139026.
2. Anotonio Gulli, "TensorFlow 1.x Deep Learning Cookbook", Packt Publishing, 2017, ISBN: 978-1788293594.
3. Sudharsan Ravichandiran, "Hands-On Deep Learning Algorithms with Python", Packt Publishing, 2019.
4. Ian Good fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	-	1	-	-	-	-	2	-	2	2
CO2	3	2	1	2	-	2	-	-	-	-	2	-	2	2
CO3	3	3	2	1	-	2	-	-	-	-	2	-	2	3
CO4	3	1	1	1	-	3	-	-	-	-	2	-	3	2
CO5	2	3	2	1	-	1	-	-	-	-	2	-	2	2

CL20505	COMPUTER NETWORKS LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1.	understand the basics and working Networking Protocols using Cisco Packet Tracer.
2.	implement the various mechanism of supporting protocols of each layer through Packet Tracer.
3.	familiar with the various routing algorithms.
4.	learn and use simulation tools.

LIST OF EXPERIMENTS

1. There are 20 PCs in your network. Five PCs are connected to one Ethernet hub, and five PCs are connected to another hub. Each hub is connected to separate switch and both the switches are connected to a separate router. The routers are connected via an Ethernet bridge. The remaining 10 PCS are connected directly to one of the two switches. How many Ethernet segments are there? Implement this scenario using Cisco Packet Tracer.
2. Write a code to implement Bit Stuffing and Byte Stuffing.
3. In CRC error correction scheme, choose pattern 1101 and data 100100. Write a code to encode the given data.
4. In an Ipv4 packet, the value of header length is 1000 in binary. Write a code to find, how many bytes of options are being carried by this packet?
5. Write a code to implement Distance Vector Routing algorithm (DVR).
6. Write a code to implement HTTP web client program to download a web page using TCP sockets.
7. Write a code to implement Border Gateway Protocol (BGP).
8. Configure a Web Server, DHCP server and a DNS server all together in a single simulation through which IP have to be allocated for the host through DHCP server, Conversion of Canonical Name to IP address to be done by DNS server and Access to the webpage has to be given by web server using Cisco Packet Tracer.
9. Study of Packet Analyzer using Wireshark Tool.

	TOTAL PERIODS	**60**

COURSE OUTCOMES

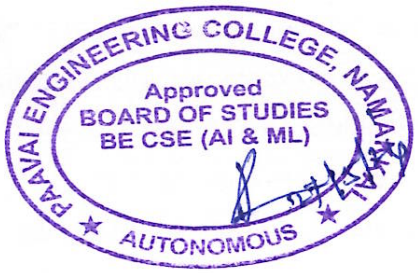
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	compare the Networking Protocols using Cisco Packet Tracer.	Analyzing (K4)
CO2	analyze the various working mechanism of supporting protocols of each layer through Packet Tracer.	Analyzing (K4)
CO3	compare the various routing algorithms in data networks.	Analyzing (K4)
CO4	analyze the performance of various network protocols using simulation tools.	Analyzing (K4)

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1	2	1	-	-	2	-	2	1	3	3
CO2	3	1	2	2	2	1	-	-	2	-	2	1	2	2
CO3	3	3	2	1	2	1	-	-	2	-	2	1	3	3
CO4	2	3	1	3	2	1	-	-	2	-	2	1	2	1



CL20506	DEEP LEARNING LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1.	understand the theoretical foundations, algorithms and methodologies of Neural Network.
2.	design and develop an application using specific deep learning models.
3.	provide the practical knowledge in handling and analysing real world applications.
4.	gaining practical experience in programming and empowering students with tools and techniques used in deep learning.

LIST OF EXPERIMENTS

1. Solving XOR problem using Multilayer perceptron.
2. Implement character and Digit Recognition using ANN.
3. Implement the analysis of X-ray image using auto encoders.
4. Implement Speech Recognition using NLP.
5. Develop a code to design object detection and classification for traffic analysis using CNN.
6. Implement online fraud detection of share market data using any one of the data analytics tools.
7. Implement image augmentation using deep RBM.
8. Implement Sentiment Analysis using LSTM.
9. Mini Project: Number plate recognition of traffic video analysis.

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	classify the characteristics of deep learning models that are useful to solve real-world problems.	Analyzing (K4)
CO2	correlate the different methodologies to create application using deep nets.	Analyzing (K4)
CO3	analyse the data by identifying and applying appropriate deep learning algorithms for variety of problems.	Analyzing (K4)
CO4	investigate different deep learning algorithms and design the test procedures to assess the efficacy of the developed model.	Analyzing (K4)

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	-	-	-	2	-	-	2	1	2	2
CO2	3	2	1	2	-	-	-	2	-	-	2	1	2	2
CO3	3	3	2	1	-	-	-	2	-	-	2	1	2	3
CO4	3	1	1	1	-	-	-	2	-	-	2	1	3	2

EN20501	CAREER DEVELOPMENT LABORATORY I	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1. enhance their writing skills.
2. evaluate their presentation skill to face the corporate world.
3. solve the quantitative aptitude problems and improve their mental ability.
4. improve the critical thinking and reasoning skills.

UNIT I	WRITING SKILLS	6

Writing Skills: The Essentials of Writing – The Importance of Structure – Types of Writing – Common Mistakes in Writing.

Activities: Email Writing – Paragraph writing – Report Writing – Story Writing – Story Telling Session: 2 – JAM Session 1.

UNIT II	PRESENTATION SKILLS AND GROUP DISCUSSION	6

Presentation Skills: Types of Presentation – Methods of Delivering Presentation – Ways to improve the Presentation- Presentation Aids; Group Discussion: Introduction-Types and Importance – Why GD – Types of GD – Evaluation Criteria- Do's and Don'ts of GD.

Activities: Presentation Session I, Group Discussion Session I, Role Play Session (Team): Level II – Personality Profile Session II- Company Profile Analysis Session II.

UNIT III	QUANTITATIVE APTITUDE	6

Simplification – Cubes and Cube Roots – Squares and Square Roots – Boats and Streams – Trains – Profit and Loss – Pipes and Cisterns.

UNIT IV	LOGICAL REASONING – I	6

Series Completion – Letter Series – Symbol Series – Number Series – Arithmetic Reasoning.

UNIT V	LOGICAL REASONING – II	6

Blood Relations – Seating Arrangement – Character Puzzle.

	TOTAL PERIODS	30

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	excel in drafting mails and speaking.	Analyzing (K4)
CO2	demonstrate the participative skills in group discussions.	Analyzing (K4)
CO3	solve problems based on quantitative aptitude.	Analyzing (K4)
CO4	enhance their logical and verbal reasoning.	Analyzing (K4)

TEXT BOOKS

1. Agarwal, R. S, "A Modem approach to Verbal and Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.2015.
2. Agarwal, R.S., "Objective General English", S.Chand & Co.2016.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude", Tata-McGraw Hill.2015.
2. "Word Power Made Easy" By Norman Lewis Wr. Goyal Publications, 2016.
3. Johnson, D. W., "Reaching out – Interpersonal Effectiveness and self-actualization", Boston: Allyn and Bacon, 2019.
4. M Tyra, K Kundan, "Magical Book on Quicker Maths", BSC Publishing Co Pvt Ltd, 5th Edition, 2018.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	3	3	1	-	-	-	-	-	-	3	2
CO2	-	2	3	-	2	-	2	-	-	-	-	-	3	2
CO3	3	2	2	2	-	-	1	-	-	-	-	-	2	3
CO4	3	2	2	-	-	1	-	-	-	-	2	-	2	3

SEMESTER – VI

CL20601	AI AND ROBOTICS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	learn the fundamentals of Robotics and Power Transmission system.
2.	know the different grippers and its selection constraints.
3.	understand the kinematic equations of robots.
4.	understand the fundamentals of machine vision system.
5.	learn the basics of robot programming and applications.

UNIT I	INTRODUCTION TO ROBOTICS	9

Definition – Laws of robotics – Robot Anatomy Configurations of robot, robot motions – Robot Drive Systems Hydraulic, pneumatic, electric – Precision of movement Resolution, accuracy, repeatability – Power transmission system – Gear drive, screw drive, belt drive, linear drive – Harmonic drive.

UNIT II	END EFFECTORS	9

Introduction – Types of End Effectors – Mechanical gripper Types of gripper mechanisms – Gripper force analysis – Other types of Grippers – Vacuum, magnetic, adhesive: Tools as End effectors – Considerations in Gripper Selection.

UNIT III	KINEMATICS OF ROBOT	9

Introduction – Matrix representation – Homogeneous transformation matrices – Representation of transformations Rotation, Translation – Denavit Hartenberg representation – Forward and inverse kinematics of robots.

UNIT IV	MACHINE VISION SYSTEM	9

Introduction – Imaging devices – Lighting techniques – Sampling and Quantization – Segmentation Thresholding, edge detection, binary morphology and grey morphology – Object recognition – Template matching, structural technique – Robotic Applications of machine vision system.

UNIT V	ROBOT PROGRAMMING AND APPLICATIONS	9

Generations of programming languages – Methods of programming – Manual, walk through, lead through, offline programming – VAL system and languages – Robot applications Material handling, machine loading and unloading, assembly, inspection.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	understand the fundamentals of Robotics and Power Transmission systems.	Understanding (K2)
CO2	identify the different grippers and its selection constraints.	Applying (K3)
CO3	diagnose the kinematic equations for robots.	Analyzing (K4)
CO4	optimize the techniques in machine vision system.	Analyzing (K4)
CO5	analyze various applications of robots and programming methods.	Analyzing (K4)

TEXT BOOKS

1. M.P.Groover, M.Weiss, R.N. Nagal, N.G.Odrey, Ashish Dutta, "Industrial Robotics Technology, Programming and Applications", Tata McGraw-Hill Education Pvt Limited, 2nd Edition, 2015.
2. S. R. Deb, Sankha Deb, "Robotics Technology and flexible Automation", 2nd edition, Tata McGraw Hill Publication, 2014.

REFERENCES

1. Danny Staple, "Learn Robotics Programming", Packt Publishing, 2nd Edition, 2021, ISBN: 978-1839218804.
2. Saeed B. Niku, "Introduction to Robotics: Analysis, Systems, Applications", 2nd edition, Pearson Education India, 2014.
3. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, "Robotics: Control, Sensing, Vision and Intelligence", Tata McGraw-Hill Publication, 1st edition, 2012.
4. SK Saha, "Introduction to Robotics", Tata McGraw-Hill Publication, Second edition, 2011.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	2	3	1	-	1	1	-	-	-	1	1	2
CO2	2	1	2	1	2	-	1	1	-	-	-	1	1	2
CO3	2	3	1	2	2	-	1	1	-	-	-	2	2	3
CO4	2	3	2	2	2	-	1	1	-	-	-	2	2	3
CO5	3	3	2	3	3	-	1	1	-	-	-	1	2	3

CL20602	DATA ANALYTICS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the fundamental concepts of Big Data.
2.	be competent in identifying the challenges in handling large volumes of data.
3.	propose scalable solutions using Hadoop.
4.	familiarize the impact of Big Data in business intelligence, scientific discovery, and in day-to-day life.
5.	learn the tools and techniques for handling large datasets.

UNIT I	INTRODUCTION	9

Introduction to Big Data – Issues and Challenges in the traditional systems – Evolution of Big Data – Four V's of Big Data – Big Data Use Cases and characteristics – Intelligent Data Analysis – Data Analytic Tools – Big Data Storage Statistical Concepts: Sampling Distributions – Re-Sampling – Statistical Inference – Prediction Error – Random Sampling.

UNIT II	BIG DATA TOOLS – I	9

Big Data Applications using Pig and Hive – Fundamentals of Hbase and ZooKeeper – IBM Infosphere Big Insights – Introduction to FLUME – KAFKA.

UNIT III	HADOOP	9

Introduction to Hadoop – Hadoop Distributed File System – Analyzing data with Hadoop – Scaling – Streaming – Clustering: Single Node and Multi Node – Working with Hadoop Commands – Working with Apache Oozie.

UNIT IV	BIG DATA TOOLS – II	9

Introduction to NoSQL – MongoDB – Spark – Cassandra – Cassandra Data Model – Data Design – Cassandra Architecture – Read and Write Data – Clients – Integrate with Hadoop: Introduction – Importance of Effective Data Visualization – Introduction to Tableau – Choosing the Right Chart Type – Using the Color Effectively Reducing Clutter – Dashboard Creation and Formatting.

UNIT V	MAP REDUCE	9

Algorithms using map reduce – Matrix-Vector – Multiplication – Word Count – Understanding inputs and outputs of MapReduce, Data Serialization – Introduction to YARN – MapReduce Vs YARN – YARN Architecture – Scheduling in YARN – Fair Scheduler – Capacity Scheduler.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	clarify the tools required for setting up Big Data Ecosystem.	Understanding (K2)
CO2	explain conceptually how Big Data is stored and organized.	Applying (K3)
CO3	explore scalable solutions using Hadoop.	Applying (K3)
CO4	process appropriate models of analysis and assess the quality of input.	Analyzing (K4)

CO5	illustrate the tools and techniques for handling large datasets.	Analyzing (K4)

TEXT BOOKS

1. Joshua N. Milligan, "Learning Tableau", Packt Publishing, 2015.
2. Chuck Lam, "Hadoop in Action", Manning Publications Co., 2018.

REFERENCES

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Edition I, ISBN-10: 1107015359 | ISBN-13: 978-1107015357, 2011.
2. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Morgan and Claypool Publishers, 2010.
3. Jonathan R. Owens, Brian Femiano, and Jon Lentz, "Hadoop Real World Solutions Cookbook", Packt Publishing, ISBN-10: 1849519129 | ISBN-13: 978-1849519120, 2013.
4. Tom White, "Hadoop the Definitive Guide", O'reilly, 4th Edition, 2015.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	3	2	1	-	-	-	-	-	-	1	3	2
CO2	1	2	3	1	1	-	-	-	-	-	-	2	3	2
CO3	3	2	3	2	2	-	-	-	-	-	-	2	3	2
CO4	1	3	2	2	1	-	-	-	-	-	-	2	3	3
CO5	3	2	3	2	3	-	-	-	-	-	-	1	3	3

CL20603	INTERNET OF THINGS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the concepts of Internet of Things.
2.	identify the various elements of an IoT System.
3.	understand the various means of communication from Node / Gateway to Cloud Platforms.
4.	identify types of data analytics and data visualization tools.
5.	make students aware of security concerns and challenges while implementing IoT solutions.

UNIT I	INTRODUCTION TO IOT	9

Introduction to IoT, Current technological trends and future prospects – Evolution of IoT, Business Scope, Relation with embedded system – Basic Architecture of an IoT, From M2M to IoT, M2M towards IoT – IoT Value Chains: An emerging industrial structure for IoT.

UNIT II	ELEMENTS OF IOT	9

Application Sensors & Actuators – Edge Networking (WSN) – Gateways – IoT Communication Model – WPAN and LPWA, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Wearable Development Boards.

UNIT III	COMMUNICATION AND CONNECTIVE TECHNOLOGIES	9

IoT Communication Model, Cloud computing in IoT, IoT in cloud architecture, logging on to cloud, Selecting and Creating cloud service, cloud based IoT platforms – IBM Watson, Google cloud.

UNIT IV	DATA ANALYTICS AND IOT PLATFORM	9

Big Data Analytics, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Storm, Data Visualization, Visualization tools for IoT.

UNIT V	HANDS-ON PROJECTS	9

Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino), DIY Kits – Soil moisture monitoring, Weather monitoring, Air quality Monitoring, Movement Detection.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	compare the technology and current trends in Internet of things.	Understanding (K2)
CO2	employ the various elements of IoT system and hardware devices.	Applying (K3)
CO3	manipulate the cloud computing and its relevance for developing IoT applications.	Applying (K3)
CO4	implement IoT applications that manages big data with data analytics and visualization tools.	Analyzing (K4)
CO5	implement hands-on projects using an appropriate software and hardware devices.	Analyzing (K4)

TEXT BOOKS

1. Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Applications and Protocols", Wiley publications.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer publications.

REFERENCES

1. Satish Jain, Shashi Singh, "Internet of Things (IOT) & Its Applications", BPB Publications, 2020, ISBN: 978-9389845761.
2. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, "Internet of Things", 2nd Edition, Wiley Publisher, 2020, ISBN: 978-9388991018.
3. Jeeva Jose, "Internet of Things", Khanna Book Publishing, 2018, ISBN: 978-9386173591
4. "Internet of Things with Arduino Cookbook", Packt Publications. Author(s): Marco Schwatrz.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	3	2	1	-	-	-	-	-	1	1	3	2
CO2	1	2	3	1	1	-	-	-	-	-	2	1	3	2
CO3	3	2	3	2	2	-	-	-	-	-	2	1	3	2
CO4	1	3	2	2	2	-	-	-	-	-	2	1	3	3
CO5	3	2	1	2	2	-	-	-	-	-	1	1	3	3

CL20604	OPTIMIZATION TECHNIQUES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	formulate and solve Linear Programming Problems (LPP).
2.	evaluate Integer Programming Problems, Transportation and Assignment Problems.
3.	obtain solution to network problems using CPM and PERT techniques.
4.	optimize the function subject to the constraints.
5.	identify and solve problems under Markovian queuing models.

UNIT I	LINEAR MODELS	9

Introduction of Operations Research – Mathematical formulation of LPP – Graphical Methods to solve LPP – Simplex Method – Big M method, Two-Phase method.

UNIT II	INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS	9

History of Deep Learning – A Probabilistic Theory of Deep Learning – Back propagation and regularization – batch normalization – VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

UNIT III	PROJECT SCHEDULING	9

Project network – Diagram representation – Floats – Critical path method (CPM) – PERT- Cost considerations in PERT and CPM.

UNIT IV	CLASSICAL OPTIMISATION THEORY	9

Unconstrained problems – necessary and sufficient conditions – Newton-Raphson method, Constrained problems – equality constraints – inequality constraints – Kuhn-Tucker conditions.

UNIT V	QUEUING MODELS	9

Introduction – Queuing Theory – Operating characteristics of a Queuing system – Constituents of a Queuing system – Service facility – Queue discipline – Single channel models – multiple service channels.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	compute Linear Programming Problems (LPP).	Applying (K3)
CO2	illustrate Integer Programming Problems, Transportation and Assignment Problems.	Applying (K3)
CO3	acquire solution to network problems using CPM and PERT techniques.	Applying (K3)
CO4	process the function subject to the constraints.	Applying (K3)
CO5	investigate problems under Markovian Queuing Models.	Applying (K3)

TEXT BOOKS

1. Hamdy A Taha, "Operations Research: An Introduction", Pearson, 10th Edition, 2017.

2. Hiller F.S, Liberman G.J, "Introduction to Operations Research", 10th Edition, McGraw Hill, 2017.

REFERENCES

1. Mykel J. Kochenderfer, Tim A. Wheeler, "Algorithms for Optimization", MIT Press, 2019, ISBN: 978-0262039420.
2. ND Vohra, "Quantitative Techniques in Management", Tata McGraw Hill, 4th Edition, 2011.
3. J. K. Sharma, "Operations Research Theory and Applications", Macmillan, 5th Edition, 2012.
4. Ravindran A., Philip D.T., and Solberg J.J, "Operations Research", John Wiley, 2nd Edition, 2007.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	2	1	1	-	-	2	-	-	-	2	2	2
CO2	1	2	1	1	2	-	-	2	-	-	-	2	1	2
CO3	1	1	1	2	2	-	-	1	-	-	-	2	2	2
CO4	3	2	2	2	1	-	-	1	-	-	-	2	2	1
CO5	1	3	2	3	2	-	-	2	-	-	-	2	1	3

CL20605	AI AND ROBOTICS LABORATORY	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1.	understand the structural details of Aristo-Six robot.
2.	learn the basic commands used in programming.
3.	know the structure of robot programming.
4.	understand the steps in generation of programming for different applications.

LIST OF EXPERIMENTS

1. Study of Aristo six axis robot.
2. Study the programming commands of Aristo six axis robot.
3. Setup and program a robot with a pneumatic gripper for pick and place operation.
4. Robot programming and simulation for welding operation.
5. Robot programming and simulation for grinding operation.
6. Robot programming and simulation for deburring operation.
7. Robot programming and simulation for assembly operation.
8. Robot programming and simulation for material handling.
9. Robot programming and simulation for polishing of components.
10. Robot programming and simulation for miscellaneous operation.

TOTAL PERIODS	**30**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	analyze the physical configuration of Aristo-Six robot.	Analyzing (K4)
CO2	illustrate the suitable commands for specific operation.	Analyzing (K4)
CO3	investigate the structure for each programming.	Analyzing (K4)
CO4	practice the robot program for various applications.	Analyzing (K4)

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	2	2	2	-	-	2	1	-	3	1	1	2
CO2	2	1	2	2	2	-	-	2	1	-	3	1	1	2
CO3	2	3	1	3	2	-	-	2	1	-	3	1	2	3
CO4	2	3	2	3	2	-	-	3	1	-	3	1	2	3

CL20606	DATA ANALYTICS LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1.	learn the different statistical measures and visualization techniques.
2.	use different methods to test on datasets.
3.	imply Decision Tree and K-Nearest algorithms for the given datasets.
4.	apply I Bayes method to analyze the data.

LIST OF EXPERIMENTS

1. Find the statistical measures of central tendency and dispersion such as min(), max(), mean(), median(), quantile(), sd() ,var() and summary() for real world datasets.
2. Demonstrate the different data visualization techniques. (Scatter Plot, Horizontal Bar Chart, Histogram, Visualization of Time Series data (Line Graphs) for applications such as weather analysis.
3. Perform the chi-square test and ANOVA F-test on datasets.
4. Implement the PCA method for dimensionality reduction on datasets.
5. Implement the RFE method and show the importance of features.
6. Implement the Decision Tree for given datasets and compute the accuracy of model.
7. Implement the K-Nearest Neighbor Algorithm for given datasets and analyze the results.
8. Implement the I Bayes method.
9. Implement simple linear regression program to predict the future values and analyses the goodness of fit.
10. Implement multivariate linear regression program to predict the future values analyses the goodness of fit.
11. Implementation of Distributed Decision Trees.

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	analyze the different statistical measures and visualization techniques.	Analyzing (K4)
CO2	figure out different methods to test on datasets.	Analyzing (K4)
CO3	diagnose the given datasets using Decision Tree and K-Nearest algorithms.	Analyzing (K4)
CO4	implement Naïve Bayes method to analyze the data.	Analyzing (K4)

CO-PO MAPPING:														
Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's) (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	3	2	-	-	-	-	-	-	3	-	3	2
CO2	1	2	3	2	-	-	-	-	-	-	3	-	3	2
CO3	3	2	3	2	-	-	-	-	-	-	3	-	3	2
CO4	1	3	2	2	-	-	-	-	-	-	3	-	3	3

EN20601	CAREER DEVELOPMENT LABORATORY II	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1.	draft resume and enhance their skills to manage stress to survive in corporate world.
2.	excel in interview skills.
3.	solve the quantitative aptitude problems and improve their problem-solving skills.
4.	improve their reasoning skills to get placed in reputed companies.

UNIT I	RESUME WRITINGS	6

Resume Writing Skills: Curriculum Vitae and Resume- Things to do while writing a Resume- Mistakes and Pitfalls to A void- Cover Letter: General Guidelines -The Content – Stress Management- Dressing Etiquette.

Activities: Corporate Resume Building Session I- JAM Session: Level III- Role Play Session (Individual): Level III- Company Profile Analysis Session III- Personality Profile Analysis Session III.

UNIT II	INTERVIEW SKILLS	6

Interview Skills: Introduction -Before the Interview – During the Interview – After the Interview- Types of Interviews.

Activities: Presentation Session: Level II- Group Discussion Session: Level III, Mock Interview Practice Session, Corporate Resume Building Session II.

UNIT III	QUANTITATIVE APTITUDE	6

Permutation and Combination – Probability: Dice, Colours, Coin, Cards; Partnership – Ages – Calendars.

UNIT IV	LOGICAL REASONING – I	6

Making Judgments – Matching Definitions – Cause and Effect.

UNIT V	LOGICAL REASONING – II	6

Directions – Syllogism – Analogy – Statements and Arguments.

	TOTAL PERIODS	30

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	construct resume and enhance their etiquettes.	Applying (K3)
CO2	demonstrate the interpersonal skills in group discussions.	Applying (K3)
CO3	compute problems based on quantitative aptitude.	Applying (K3)
CO4	expose their logical and verbal reasoning by scoring the expected percentage to get placed in reputed companies.	Applying (K3)

TEXT BOOKS

1. Agarwal, R. S, "A Modem approach to Verbal and Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.2015.
2. Agarwal, R.S., "Objective General English", S.Chand & Co.2016.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude", Tata-McGraw Hill.2015.
2. "Word Power Made Easy", By Norman Lewis Wr. Goyal Publications, 2016.
3. Johnson, D. W., "Reaching out – Interpersonal Effectiveness and self-actualization", Boston: Allyn and Bacon.2019.
4. M Tyra, K Kundan, "Magical Book on Quicker Maths", BSC Publishing Co Pvt Ltd, 5th Edition, 2018.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	3	3	1	-	-	-	-	-	-	3	2
CO2	-	2	3	-	2	-	2	-	-	-	-	-	3	2
CO3	3	2	2	2	-	-	1	-	-	-	-	-	2	3
CO4	3	2	2	-	-	1	-	-	-	-	2	-	2	3

PAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
English
12/8/22
AUTONOMOUS

PROFESSIONAL ELECTIVE – I

CL20151	CYBER SECURITY	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	know the fundamental mathematical concepts related to security.
2.	learn the concepts of various cryptographic techniques.
3.	know the fundamentals of cybercrimes and the cyber offenses.
4.	understand the integrity and authentication process.
5.	familiarize various cyber threats, attacks, vulnerabilities, defensive mechanisms, security policies and practices.

UNIT I	INTRODUCTION TO NUMBER THEORY	9

Finite Fields and Number Theory: Modular arithmetic – Euclidian Algorithm – Primality Testing: Fermats and Eulers theorem – Chinese Reminder theorem – Discrete Logarithms.

UNIT II	CRYPTOGRAPHIC TECHNIQUES, AND INTEGRITY & AUTHENTICATION	9

Symmetric key Cryptographic Techniques: Introduction to Stream cipher, Block cipher: DES, AES – Asymmetric key Cryptographic Techniques: Principles RSA, Elliptic Curve cryptography (ECC) – Hash functions – Secure Hash Algorithm (SHA) – Message Authentication Code (MAC).

UNIT III	CYBER CRIMES AND CYBER OFFENCES	9

Classification of cybercrimes, planning of attacks, social engineering: Human based, Computer based: Cyber stalking, Cyber I and Cyber-crimes.

UNIT IV	CYBER THREATS, ATTACKS AND PREVENTION	9

Phishing, Password cracking, Keyloggers and Spywares, DoS and DdoS attacks, SQL Injection Identity Theft (ID): Types of Identity Theft, Techniques of ID theft.

UNIT V	CYBER SECURITY POLICIES AND PRACTICES	9

Security Policies: Determining the policy needs, writing security policies, Internet and email security policies, Compliance and Enforcement of policies, Review.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	associate the fundamental mathematical concepts related to security.	Understanding (K2)
CO2	adapt the concepts of various cryptographic techniques, and its implementation.	Applying (K3)
CO3	classify the fundamentals of cybercrimes and the cyber offenses.	Applying (K3)
CO4	customize the integrity and authentication process.	Applying (K3)
CO5	investigate various cyber threats, attacks, vulnerabilities, defensive mechanisms, security policies and practices.	Applying (K3)

TEXT BOOKS

1. Jan L. Harrington, "Network Security – A Practical Approach", Morgan Kaufmann Publishers – An Imprint of Elsevier, 2005.
2. William Stallings, "Cryptography and Network Security – Principles and Practice", Pearson Education Asia, Fourth Edition, 2005.

REFERENCES

1. Nancy R.Mead, Carol Woody, "Cyber Security Engineering: A practical approach for systems and software assurance", 2016.
2. Martti Lehto, Pekka Neittaanmaki, "Cyber Security: Analytics, Technology and Automation", edited Springer International Publishing Switzerland, 2015.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, "Security in Computing", 5th Edition, Pearson Education, 2015.
4. George K.Kostopoulous, "Cyber Space and Cyber Security", CRC Press, 2013.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO2	2	1	1	1	-	-	-	-	-	-	-	1	3	3
CO3	3	2	1	1	-	2	-	-	-	-	-	1	3	1
CO4	2	2	1	1	-	-	-	-	-	-	-	1	3	1
CO5	3	2	1	1	-	2	-	-	-	-	-	1	3	2

CL20152	INFORMATION EXTRACTION AND RETRIEVAL	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the different ways for extraction of multimedia data.
2.	learn and explore the information extraction techniques.
3.	apply the information retrieval algorithms for real time applications.
4.	understand the algorithms of information retrieval techniques.
5.	understand the role of information retrieval systems in real-time applications.

UNIT I	INTRODUCTION TO INFORMATION EXTRACTION	9

Introduction – Origins – Text, Audio, Image, Video Extraction – Visual object Feature Localization – Entropy based Image Analysis – 3D shape Extraction Techniques – Semantic Multimedia Extraction using Audio & Video – Multimedia Web Documents.

UNIT II	TEXT EXTRACTION	9

Pre-processing Techniques – Clustering – Probabilistic Models – Browsing and Query Refinement on presentation Layer – Link Analysis – Visualization Approaches and its Operations.

UNIT III	INFORMATION RETRIEVAL SYSTEMS	9

Text formats – Retrieval and Ranking – Evaluation strategies – Tokens – Query processing – Static Inverted Indices – Dynamic Inverted Indices – Index compression – Categorization and Filtering Classifiers – Probabilistic, Linear, Similarity based, Generalized Linear, Information Theoretic models – XML Retrieval.

UNIT IV	ALGORITHMS ON INFORMATION RETRIEVAL	9

Introduction – Strategies – Utilities – Crossing the language barrier- Cross Language strategies with Utilities – Efficiency Multidimensional data model – Parallel Information Retrieval – Distributed Information Retrieval.

UNIT V	APPLICATIONS	9

Sound Authoring Data with Audio MME – CBR Systems – Implementation of Message Recognition Systems – Paralinguistic Information Retrieval in Broadcast – Text mining Applications – Pre-processing Applications using Probabilistic and Hybrid Approaches – Web Search.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	classify the information extraction techniques for real time applications.	Understanding (K2)
CO2	customize systems based on the concepts of information extraction.	Applying (K3)
CO3	apply data specific information retrieval techniques.	Applying (K3)
CO4	explore the algorithms of information retrieval techniques.	Applying (K3)
CO5	use the concepts of information classification and clustering in wide range of other applications.	Applying (K3)

TEXT BOOKS

1. Mark T. Maybury, "Multimedia Information Extraction", Wiley (IEEE), John Wiley & Sons, 2012.
2. Ronen Feldman, James Sanger, "Text Mining Handbook", Cambridge University press, 2006.

REFERENCES

1. Stefan Buttcher, LA Clarke, Gox V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", MIT Press, 2016.
2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to information Retrieval", Cambridge University press, 2008.
3. Marie-Francine Moens, "Information Extraction: Algorithms and Prospects in Retrieval context", Springer Netherlands, 2006.
4. David A. Grossman, Ophir Frieder, "Information Retrieval: Algorithms and Heuristics", Second Edition, Springer, 2004.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	1	1	-	-	-	1	2	1	2	2	1
CO2	3	2	3	1	1	-	-	-	1	2	1	3	1	2
CO3	3	3	3	1	3	-	-	-	1	2	1	2	2	1
CO4	3	3	3	1	3	-	-	-	1	2	1	2	2	1
CO5	3	3	2	1	3	-	-	-	1	3	1	3	1	3

CL20153	ADVANCED MACHINE LEARNING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	learn advanced machine learning concepts.
2.	understand the knowledge representation.
3.	understand the credibility.
4.	understand tress and rules.
5.	make work of machine learning tools.

UNIT I	INTRODUCTION	9

Fielded Applications, The Data Mining Process, Machine Learning and Statistics, Generalization as Search, Data Mining and Ethics, Input: concepts, instances, attributes, Preparing the Input, output: Knowledge representation- Tables, Linear Models, Trees, Rules, Instance-Based Representation, and Clusters.

UNIT II	KNOWLEDGE REPRESENTATION	9

Tables, Linear Models, Trees, Rules, Instance-Based Representation, Clusters, and Algorithms: the basic methods, Inferring Rudimentary Rules, Simple Probabilistic Modeling, And Divide-and-Conquer: Constructing Decision Trees, Covering Algorithms: Constructing Rules, Mining Association Rules, Linear Models, Instance-Based Learning, Clustering, and Multi-Instance Learning.

UNIT III	CREDIBILITY	9

Training and Testing, Predicting Performance, Cross-Validation, Other Estimates, Hyper parameter Selection, Comparing Data Mining Schemes Predicting Probabilities, Counting the Cost, Evaluating Numeric Prediction, The Minimum Description Length Principle, Applying MDL to Clustering, using a Validation Set for Model Selection.

UNIT IV	TREES AND RULES	9

Decision Trees, Classification Rules, Association Rules, extending instance-based and linear models- Instance-Based Learning, Extending Linear Models, Numeric Prediction with Local Linear Models, WEKA Implementations. Data transformations- Attribute Selection, Discretizing Numeric Attributes, Projections, Sampling, Cleansing, Transforming Multiple Classes to Binary Ones, Calibrating Class Probabilities.

UNIT V	MACHINE LEARNING TOOLS	9

KNIME, Accord. Net, Scikit-Learn, TensorFlow, PyTorch, RapidMiner, Google Cloud AutoML, Jupyter Notebook, Apache Mahout, Azure Machine Learning studio, MLLIB, Orange3, IBM Watson, Pylearn2.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	describe the basics of machine learning concepts.	Understanding (K2)
CO2	acquire different knowledge representation techniques.	Applying (K3)
CO3	customize different validation models to improve the performance.	Applying (K3)

CO4	employ different machine learning tools for implementing real-world applications.	Applying (K3)
CO5	demonstrate the concepts of Machine Learning Tools.	Applying (K3)

TEXT BOOKS

1. "Data Mining: Practical Machine Learning Tools and Techniques", Ian Witten, Eibe Frank, Mark A. Hall, Christopher Pal, 4th Edition, Morgan Kaufman, 2011.
2. "Machine Learning: The art of science and algorithms that make sense of data", Peter A. Flach, 1st Edition, Cambridge University Press, 2012.

REFERENCES

1. "Machine Learning for Absolute Beginners", Oliver Theobald, Independently Published (January 1, 2018), 2nd Edition, 2017. ISBN-10: 1549617214, ISBN-13: 978-1549617218.
2. "Interpretable Machine Learning", Christoph Molnar, Independently published (February 28, 2022), 2nd Edition, 2020. ISBN-13: 979-8411463330.
3. John Hearty, "Advanced Machine Learning with Python", Packt Publishing, 2016, ISBN-13: 978-1784398637.
4. Dr.Reema Thareja, "Data Science and Machine Learning using Python", McGraw Hill, Standard Edition, 2022. ISBN-13: 978-9355322142.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	1	-	-	3	-	-	-	2	2	1
CO2	3	2	3	2	1	-	-	2	-	-	-	3	1	2
CO3	2	3	3	2	3	-	-	1	-	-	-	2	2	1
CO4	2	3	3	2	3	-	-	1	-	-	-	2	2	1
CO5	3	3	2	2	2	-	-	3	-	-	-	3	1	3

CL20154	NATURE INSPIRED COMPUTING TECHNIQUES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the fundamentals of nature inspired techniques.
2.	gain knowledge in inspired computing by nature.
3.	understand Swarm Intelligence.
4.	study the Immuno-computing techniques.
5.	learn computing with new natural materials.

UNIT I	INTRODUCTION	9

From Nature-to-Nature Computing, Philosophy, Three Branches: A Brief Overview, Individuals, Entities and Agents – Parallelism and Distributive Interactivity, Adaptation Feedback-Self-Organization-Complexity, Emergence and, Bottom-up Vs Top-Down- Determination, Chaos and Fractals.

UNIT II	COMPUTING INSPIRED BY NATURE	9

Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm – Genetic Algorithms, Reproduction – Crossover, Mutation, Evolutionary Programming Genetic Programming.

UNIT III	SWARM INTELLIGENCE	9

Introduction – Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO).

UNIT IV	IMMUNO COMPUTING	9

Introduction- Immune System, Physiology and main components Pattern Recognition and Binding, Immune Network Theory – Danger Theory, Evaluation Interaction Immune Algorithms, Introduction – Genetic algorithms, Bone Marrow Models, Forest's Algorithm Artificial Immune Networks.

UNIT V	COMPUTING WITH NEW NATURAL MATERIALS	9

DNA Computing: Motivation, DNA Molecule Adleman's experiment, Test tube programming language, Universal DNA Computers, PAM Model Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical to DNA Computing.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	describe the fundamentals of nature inspired techniques.	Understanding (K2)
CO2	acquire knowledge in inspired computing by nature.	Applying (K3)
CO3	explore Swarm Intelligence.	Applying (K3)
CO4	express the Immuno-computing techniques.	Applying (K3)
CO5	illustrate computing with new natural materials.	Applying (K3)

TEXT BOOKS

1. S. Balamurugan, Anupriya Jain, Sachin Sharma, Dinesh Goyal, Sonia Duggal, Seema Sharma, "Introduction to Nature-Inspired Computing", Wiley Publisher, 2021.
2. Himansu Das, Jitendra Kumar Rout, Minakhi Rout, "Nature Inspired Computing for Data Science", Springer Nature Switzerland AG, 1st Edition, 2020. ISBN-13: 978-3030338220.

REFERENCES

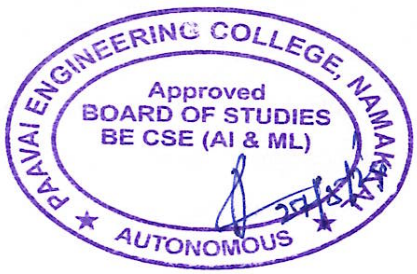
1. "Nature-Inspired Computing: Concepts, Methodologies, Tools, and Applications", Information Reso Management Association, IGI Global, 1st Edition, 2016. ISBN-10: 1668428385; ISBN-13: 9781668428382.
2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", IT Press, Cambridge, MA, 2008.
3. Albert Y. Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
4. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 1st Edition, 2007.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	1	2	3	2	-	-	-	-	2	2	1
CO2	3	2	3	1	2	2	2	-	-	-	-	3	1	2
CO3	2	3	3	3	2	1	2	-	-	-	-	2	2	1
CO4	2	3	3	3	2	2	2	-	-	-	-	2	2	1
CO5	3	3	2	2	2	3	3	-	-	-	-	3	1	3



PROFESSIONAL ELECTIVE – II

CL20251	ENGINEERING PREDICTIVE ANALYTICS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	explain terminology, technology and applications of predictive analysis.
2.	apply data preparation techniques and generate appropriate association rules.
3.	discuss various descriptive models, their merits, demerits and application.
4.	describe various predictive modelling methods.
5.	introduce the text mining tools, technologies and case study which is used in day-to-day analytics cycle.

UNIT I	INTRODUCTION TO PREDICTIVE ANALYTICS	9

Overview of Predictive Analytics – Setting Up the Problem – Data Understanding- Single Variable- Data Visualization in One Dimension- Data Visualization, Two or Higher Dimensions- The Value of Statistical Significance- Pulling It All Together into a Data Audit.

UNIT II	DATA PREPARATION AND ASSOCIATION RULES	9

Data Preparation – Variable Cleaning- Feature Creation- Item sets and Association Rules-Terminology- Parameter Settings- How the Data Is Organized- Measures of Interesting Rules- Deploying Association Rules- Problems with Association Rules- Building Classification Rules from Association Rules.

UNIT III	MODELLING	9

Descriptive Modeling – Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation.

UNIT IV	PREDICTIVE MODELLING	9

Decision Trees – Logistic Regression -Neural Network Model – K-Nearest Neighbors – I Bayes – Regression Models – Linear Regression – Other Regression Algorithms.

UNIT V	TEXT MINING	9

Motivation for Text Mining – A Predictive Modeling Approach to Text Mining- Structured vs. Unstructured Data- Why Text Mining Is Hard- Data Preparation Steps- Text Mining Features- Modeling with Text Mining Features – Regular Expressions – Case Studies: Survey Analysis.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	explain terminology, technology and applications of predictive analysis.	Understanding (K2)
CO2	summarize data preparation techniques.	Understanding (K2)
CO3	discuss various descriptive models, their merits, demerits and application.	Understanding (K2)
CO4	describe principles of predictive modelling and apply them to achieve real, pragmatic solutions.	Understanding (K2)

CO5	elaborate the features and applications of text mining.	Understanding (K2)

TEXT BOOKS

1. Mangey Ram, Vijay Kumar, "Predictive Analytics: Modelling and Optimization", CRC Press, 1st Edition, 2021. E-Book ISBN: 9781003083177.
2. Krishna Kumar Mohbey, Arvind Pandey, Dharmendra Singh Rajput, "Predictive Analytics Using Statistics and Big Data: Concepts and Modeling", Betham Books, 2020. ISBN-13: 978-9811490507.

REFERENCES

1. Eric Seigal, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", 1st Edition, 2015. ISBN: 9781119145677, Online ISBN: 9781119172536.
2. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014.
3. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.
4. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, "An Introduction to Statistical Learning with Applications in R", Springer, 2013.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	2	1	1	-	-	2	-	-	-	2	2	2
CO2	1	2	1	1	2	-	-	2	-	-	-	2	1	2
CO3	1	1	1	2	2	-	-	1	-	-	-	2	2	2
CO4	3	2	2	2	1	-	-	1	-	-	-	2	2	1
CO5	1	3	2	3	2	-	-	2	-	-	-	2	1	3

CL20252	COMPUTER VISION	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	review the basics of image processing techniques for computer vision.
2.	understand various features and segmentation techniques.
3.	learn about images, histogram and binary vision.
4.	apply three-dimensional image analysis techniques.
5.	study real world applications of computer vision algorithms.

UNIT I	INTRODUCTION	9

Image Processing, Computer Vision, what is Computer Vision – Low-level, Mid-level, High-level; Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

UNIT II	FEATURE EXTRACTION AND FEATURE SEGMENTATION	9

Feature Extraction – Edges – Canny, LOG, DOG – Line detectors (Hough Transform), Corners – Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters – Gabor Filters and DWT – Image Segmentation – Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation.

UNIT III	IMAGES, HISTOGRAMS, BINARY VISION	9

Simple pinhole camera model – Sampling – Quantization – Colour images – Noise – Smoothing – 1D and 3D histograms – Histogram/Image Equalization – Histogram Comparison – Back-projection – k-means Clustering – Thresholding – Threshold Detection Methods – Variations on Thresholding – Mathematical Morphology – Connectivity.

UNIT IV	3D VISION AND MOTION	9

Methods for 3D vision – Projection schemes – Shape from shading – Photometric stereo – Shape from texture – Shape from focus – Active range finding – Surface representations – Point-based representation – Volumetric representations – 3D Object recognition – 3D Reconstruction – Introduction to motion – Triangulation – Bundle adjustment – Translational alignment – Parametric motion – Spline-based motion – Optical flow – Layered motion.

UNIT V	APPLICATIONS	9

Overview of Diverse Computer Vision Applications: Document Image Analysis – Biometrics – Object Recognition – Tracking – Medical Image Analysis – Content-Based Image Retrieval – Video Data Processing – Virtual Reality and Augmented Reality.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	implement image processing techniques for computer vision.	Applying (K3)

CO2	explain various feature extraction, segmentation and object recognition methods.	Applying (K3)
CO3	examine the images, histogram and binary vision.	Applying (K3)
CO4	handle histogram transforms for detection of geometric shapes like line, ellipse and objects.	Applying (K3)
CO5	simulate 3D vision process and motion estimation techniques.	Applying (K3)

TEXT BOOKS

1. Steve Holden, "Computer Vision: Advanced Techniques and Applications", Clanrye International, 2019.
2. E.R. Davies, "Computer Vision: Principles, Algorithms, Applications, Learning", Academic Press, 2017.

REFERENCES

1. Berthold Klaus, Paul Horn, "Robot Vision", McGraw-Hill, 2013.
2. Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
3. Scott Krig, "Computer Vision Metrics: Survey, Taxonomy and Analysis", Apress Berkeley, CA, 2014.
4. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	1	-	-	1	-	-	1	2	2	1
CO2	3	2	3	2	1	-	-	1	-	-	1	2	1	2
CO3	2	3	3	2	3	-	-	1	-	-	1	2	2	1
CO4	2	3	3	2	3	-	-	1	-	-	1	2	2	1
CO5	3	3	3	2	2	-	-	1	-	-	1	3	1	3

CL20253	BLOCK CHAIN AND CRYPTOGRAPHY	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the basics of Blockchain Technology.
2.	analyze the mechanism of digital money and Cryptography.
3.	summaries the necessary bit coin and crypto currency background.
4.	apply the function of initial coin offerings.
5.	implement the applications of Block chain.

UNIT I	INTRODUCTION TO BLOCKCHAIN	9

Centralized vs. Decentralized Systems – Layers of Blockchain – Importance of Blockchain – Limitations of Centralized Systems – Blockchain Adoption – Blockchain Uses and Use Cases – Laying the Blockchain Foundation – Cryptography – Game Theory – Properties of Blockchain Solutions – Blockchain Applications.

UNIT II	DIGITAL MONEY AND CRYPTOGRAPHY	9

Interbank Payments: Same bank & Different banks – Correspondent Bank Accounts – Central Bank Accounts – International Payments – e-Money Wallets – Cryptography – Encryption and Decryption – Hashes -Digital Signatures – Alice and Bob.

UNIT III	BITCOIN AND CRYPTOCURRENCY	9

A basic Cryptocurrency – Creation of coins – Bitcoin – Working with Bitcoin – The Bitcoin Blockchain – Block Structure, The Genesis Block – The Bitcoin Network – Network Discovery for a New Node, Bitcoin Transactions, Consensus and Block Mining, Block Propagation – Bitcoin Scripts.

UNIT IV	INITIAL COIN OFFERINGS AND INVESTING	9

ICOs- Whitepapers- The Token Sale – ICO Funding Stages- Whitelisting- Funding Caps- Treasury- Exchange Listing- Pricing-Price utility tokens- Risks and Mitigations – Market Risk-Liquidity Risk- Exchange Risks-Wallet Risks-Regulatory Risks-Scams.

UNIT V	BLOCKCHAIN APPLICATIONS	9

Transaction Workflow, Simple Payment Verification, Blockchain Forks – Unpacking Ethereum – Overview: Ethereum Virtual Machine – Decentralized Applications – Decentralized Organizations – Blockchain in Science, Reproducibility Crisis, Clinical Trials, Reputation System, Pharmaceutical Drug Tracking.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	adapt the basics of Block Chain.	Applying (K3)
CO2	demonstrate the digital transaction in same bank and different bank.	Applying (K3)
CO3	compute the Bitcoin transactions.	Applying (K3)
CO4	explore the functions of Bitcoin and make use of it to solve problems.	Applying (K3)

CO5	demonstrate the applications of Block chain.	Applying (K3)

TEXT BOOKS

1. Andreas Bolfing, "Cryptographic Primitives in Blockchain Technology", Oxford University Press, 2020.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

REFERENCES

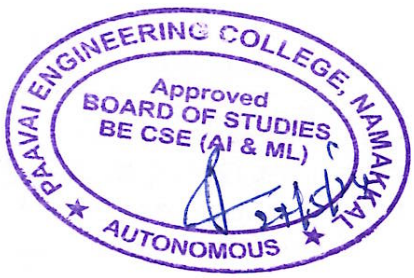
1. Bikramaditya Singhal, Priyansu Sekhar Panda, Gautam Dhamej, "Beginning Blockchain – A Beginner's Guide to Building Blockchain", Solutions Apress, 2018.
2. Antony lewis, "The Basics of Bitcoins and Blockchains", Mango Publishing Group, 2018.
3. Bashir, Imran, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Springer, 2017.
4. Joseph Bonneau, "SoK: Research perspectives and challenges for Bit coin and crypto currency", IEEE Symposium on security and Privacy, 2015.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	1	1	-	-	3	-	2	-	2	2	1
CO2	3	2	3	3	3	-	-	2	-	3	-	3	1	2
CO3	2	3	3	3	3	-	-	2	-	3	-	2	2	1
CO4	2	3	3	3	3	-	-	2	-	3	-	2	2	1
CO5	3	3	3	3	3	-	-	3	-	3	-	3	1	3



CL20254	HUMAN MACHINE INTERACTION	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the basic concepts of Human-Computer Interactions.
2.	provide the basic knowledge on the levels of interaction, design models, techniques and validations.
3.	make the learners to think in design perspective and to evaluate interactive design.
4.	use the guidelines of HCI to analyse and propose solution for real life applications.
5.	become familiar with recent technology trends and challenges in HCI domain.

UNIT I	HCI FOUNDATIONS	9

Input–output channels, Human memory, thinking: reasoning and problem solving, Emotion, Individual differences, Psychology and the design of interactive systems, Text entry devices, Positioning, pointing and drawing, Display devices, Devices for virtual reality and 3D interaction, Physical controls, sensors and special devices, Paper: printing and scanning.

UNIT II	DESIGNING INTERACTION	9

Overview of Interaction Design Models, Discovery – Framework, Collection – Observation, Elicitation, Interpretation – Task Analysis, Storyboarding, Use Cases, Primary Stakeholder Profiles, Project Management Document.

UNIT III	INTERACTION DESIGN MODELS	9

Model Human Processor – Working Memory, Long-Term Memory, Processor Timing, Keyboard Level Model – Operators, Encoding Methods, Heuristics for M Operator Placement, What the Keyboard Level Model Does Not Model, Application of the Keyboard Level Model, GOMS – CMN-GOMS Analysis, Modeling Structure, State Transition Networks – Three-State Model, Glimpse Model, Physical Models, Fitts' Law.

UNIT IV	GUIDELINES IN HCI	9

Shneiderman's eight golden rules, Norman's Sever principles, Norman's model of interaction, Nielsen's ten heuristics, Heuristic evaluation, contextual evaluation, Cognitive walk-through.

UNIT V	COLLABORATION AND COMMUNICATION	9

Face-to-face Communication, Conversation, Text-based Communication, Group working, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	examine the basic concepts of human-computer interactions.	Applying (K3)
CO2	employ the processes of human-computer design interaction.	Applying (K3)
CO3	classify the various interaction design models.	Applying (K3)

CO4	apply the interface design guidelines for evaluating the developed interactions.	Applying (K3)
CO5	illustrate the different levels of communication across the application stakeholders.	Applying (K3)

TEXT BOOKS

1. Meena K, "Human Computer Interaction", PHI Learning, 2014.
2. Hans-Jorg Bullinger, "Human-Computer Interaction", Lawrence Erlbaum Associates Publisher.

REFERENCES

1. Shneiderman, Plaisant, Cohen and Jacobs, "Designing the User Interface: Strategies for Effective Human Computer Interaction", 5th Edition, Pearson Publishers, 2010.
2. A Dix, Janet Finlay, G D Abowd, R Beale, "Human-Computer Interaction", 3rd Edition, Pearson Publishers, 2008.
3. Serengul Smith-Atakan, "Human-Computer Interaction: Basics and Practice", Cengage India, 2010.
4. Jakob Nielsen, "Advances in Human-computer Interaction", Ablex Publishing Corporation.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	2	1	1	-	-	-	-	2	-	2	2	1
CO2	2	1	2	1	1	-	-	-	-	2	-	2	1	2
CO3	3	1	2	2	3	-	-	-	-	2	-	2	2	1
CO4	2	1	2	2	2	-	-	-	-	2	-	2	2	1
CO5	2	1	2	2	2	-	-	-	-	2	-	2	1	3

OPEN ELECTIVE – I

CL20901	GREEN COMPUTING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the existing green computing strategies, fundamental challenges in achieving green operations of computing units and directions to solve some of them.
2.	apply the strategies and assets of GreenIT.
3.	learn by improving the socio-cultural aspects of GreenIT.
4.	understand Cloud and Quantum Computing technologies.
5.	study the regulatory and governance issues surrounding IT industry.

UNIT I	GREEN COMPUTING FUNDAMENTALS	9

Information Technology and Environment – Business and Environment – Green Enterprise Characteristics – Green Vision – Green Strategic Points – Green Value – Green IT Opportunity – Environmental Intelligence – Business Intelligence – Envisioning the Green Future.

UNIT II	GREEN IT STRATEGIES AND ASSETS	9

Introducing GreenIT Strategies – GreenIT Drivers – GreenIT Business Dimensions – GreenIT Metrics and Measurements – Green IT Readiness and CMM – Green Assets Buildings – GreenIT Hardware – Green Data Centers – Data servers Optimization and Virtualization – Cloud Computing and Data Centers – Networking and Communication Infrastructure – Managing Devices for Central Green Services.

UNIT III	SOCIO-CULTURAL ASPECTS OF GREEN IT	9

GreenIT's Social Impact – Green Socials take holders – Role based view of GreenIT – Green User practices – Attitude and Subjectivity in GreenIT – GreenIT Ethics and Code Conduct – Privacy and security of Green Information – GreenIT project – Green HR and Changing Organization Structures – Green Virtual Communities.

UNIT IV	EMERGENT CARBON ISSUES, TECHNOLOGIES AND FUTURE	9

Future Carbon Landscape – Green ICT and Technology Trends – Cloud Computing – SaaS – Nano technologies – Quantum Computing – Eco design – Bio mimicry – New Renewable Energies – Green ICT- Business and Economic Trends.

UNIT V	CASE STUDIES	9

Applying GreenIT Strategies and Applications to a Hospital, Packing Industry and Telecom Sector.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	describe the existing green computing strategies.	Understanding (K2)
CO2	assign the strategies and assets of GreenIT.	Applying (K3)
CO3	illustrate by improving the socio-cultural aspects of GreenIT.	Applying (K3)
CO4	handle Cloud and Quantum Computing technologies.	Applying (K3)
CO5	process the regulatory and governance issues surrounding IT industry.	Applying (K3)

TEXT BOOKS

1. Bhuvan Unhelkar, "Green IT Strategies and Applications: Using Environmental Intelligence", CRC Press, 2011, ISBN: 978-1-4398-3760.
2. Toby J. Velte, Anthony T. Velte, Robert Elsenpeter, "Green IT", First Edition, Mc-Graw Hill, 2008, ISBN: 978-0-07-159923-8, Pages: 307.

REFERENCES

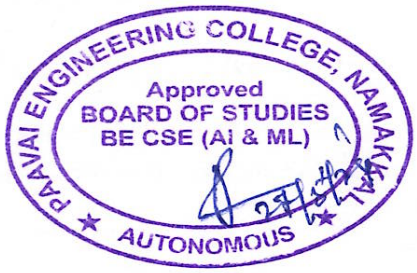
1. John Lamb, "The Greening of IT – How Companies Can Make a Difference for the Environment", IBM Press, 2009, ISBN: 978-0-13-715083-0.
2. Bud E. Smith, "Green Computing: Tools and Techniques for Saving Energy, Money, and Resources", Auerbach Publications, 2013. ISBN-13: 978-1466503403.
3. Aryan Chaudhary, Preeta Sharan, Maheswari R, "Innovative Computing for Green Technologies", 2022. ISBN-13: 979-8886846737.
4. Dr.P.Prabu, Dr.T.Indumathi, "Environmental Science and Green Computing", Bonfring Technology Solutions, 2017. ISBN-13: 978-9386638625.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	1	-	3	1	-	-	1	2	2	1
CO2	3	2	2	2	1	-	3	1	-	-	1	2	1	2
CO3	3	2	2	2	2	-	3	1	-	-	1	2	2	1
CO4	3	2	2	2	2	-	3	1	-	-	1	2	2	1
CO5	3	2	2	2	1	-	3	1	-	-	1	2	1	3



CL20902	ARTIFICIAL INTELLIGENCE	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the basic concepts of intelligent agents.
2.	develop general purpose problem-solving agents using search engines.
3.	employ AI search techniques to solve some of today's real-world problems.
4.	emphasis the Logical Agents.
5.	elaborate Knowledge Representation and Planning.

UNIT I	INTELLIGENT AGENTS	9

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents Problem solving agents – search algorithms – uninformed search strategies.

UNIT II	PROBLEM SOLVING	9

Heuristic search strategies – heuristic functions Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments.

UNIT III	GAME PLAYING AND CSP	9

Game theory – Optimal decisions in games – Alpha-Beta search – Monte-Carlo tree search – Stochastic games – Partially observable games Constraint Satisfaction Problems – Constraint propagation – Backtracking search for CSP – Local search for CSP – Structure of CSP.

UNIT IV	LOGICAL AGENTS	9

Knowledge-based agents – Propositional logic – Propositional theorem proving – Propositional model checking – Agents based on propositional logic – First-order logic – Syntax and Semantics – Knowledge representation and engineering – Inferences in first-order logic – Forward chaining – Backward chaining – Resolution.

UNIT V	KNOWLEDGE REPRESENTATION AND PLANNING	9

Ontological engineering – categories and objects – events – mental objects and modal logic – reasoning systems for categories – reasoning with default information Classical planning – algorithms for classical planning – heuristics for planning – hierarchical planning – non-deterministic domains – time, schedule, and resources – analysis.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	explain the basic concepts of intelligent agents.	Understanding (K2)
CO2	use appropriate algorithms for problem-solving.	Applying (K3)
CO3	produce a design for Game playing.	Applying (K3)
CO4	simulate and implement logical reasoning agents.	Applying (K3)
CO5	illustrate and implement Knowledge Representation and Planning.	Applying (K3)

TEXT BOOKS

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.
2. Charniak, "Introduction to Artificial Intelligence and Expert Systems", Pearson Education India, 1st Edition, 2015. ISBN-13: 978-8120307773.

REFERENCES

1. Deepak Khemani, (http://nptel.ac.in/), Tata McGraw Hill Education, 2013.
2. Wolfgang Ertel, Nathanael T. Black, "Introduction to Artificial Intelligence", Springer London Ltd, 2011. ISBN-13: 978-0857292988.
3. Kevin Night, Elaine Rich, and Nair B, "Artificial Intelligence", McGraw Hill, 2008.
4. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	1	-	-	1	-	-	-	3	2	1
CO2	3	2	3	2	1	-	-	1	-	-	-	2	1	2
CO3	3	3	3	2	2	-	-	1	-	-	-	1	2	1
CO4	3	3	3	2	2	-	-	1	-	-	-	2	2	1
CO5	3	3	2	2	2	-	-	1	-	-	-	2	1	3

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
BE CSE (AI & ML)
AUTONOMOUS